CS3305 Data Structures

Spring 2021

Assignment No. 1

**For both problems follow the Program Submission guidelines outlined on D2L**

1a.

Study of Basic C++ Program Implementation using on **CodeLite**.

Download and install the CodeLite on your PC (or laptop). You may use **MS Visual C++** (community edition). You can use **repl.it** /**MS Visual Studio / Dev C++** or any other IDE that you find useful. If you use repl.it you can download the source code as a zip file. Alternatively, you can copy/paste the code into Notepad and save it as a cpp file.

All programs should have the following heading

/\* Name:

\* Date

\* Brief Description of the program

\*

\*/

**Remember to comment your program and use user-friendly variable naming conventions**

**1a. (40 points**)

**Body Mass Index** The purpose of Assignment 1A is to make sure that you know how to write a small program that reads some information, does a calculation, and prints results that are based on that calculation. Write a short program called bmi.cxx to calculate a person's "body mass index" as described below.  
**Input.** The program asks the user for these pieces of information:

1. Your weight in pounds
2. Your height in feet and inches (two separate input numbers)

The program must prompt for these items and read them in the order listed above.  
**Output.** The program then prints messages with this information:

1. The person's weight in kilograms, rounded to two decimal places (as shown on page 31 of the text). (Information for the calculation: There are 0.45359237 kg per pound.)
2. The person's height in centimeters, rounded to one decimal place. (Information for the calculation: There are 2.54 cm per inch.)
3. The person's metric body mass index, rounded to one decimal place. This is calculated as:  
   10,000 × (weight in kg) ÷ (height in cm)²  
   **Note:** There is a "division" symbol in the middle of the above formula and a "square" symbol at the end.
4. A message about the person's height. The message must be one of these:
   * If the height is more than 215 cm: Budge up, yeh great giant, you be taller than Hagrid.
   * If the height is less than 7 cm: You do look a great deal like a mouse.
   * Otherwise: You are a fugitive from the law of averages.

Check that the program compiles and runs correctly. Submit your assignment in D2L.

1b. (**30 points**)

Develop a program with a function to determine whether a positive integer is a perfect number. The "main" function needs to test this function by using test cases which represent all possible behaviors of the function. Use good design principles including the preconditions and postconditions outlined by the book. Check that the program compiles and runs correctly. Submit your assignment in D2L.

1c. For each of the following code fragments, give an analysis of the running time

(Big-Oh notation) (**5 points each total 30 points**)

a.

|  |
| --- |
| sum = 0;  for (int i = 0; i < n; i++)  sum++; |

b.

|  |
| --- |
| sum = 0;  for (int i = 0; i < n; i++)  for (int j = 0; j < n; j++)  sum++; |

c.

|  |
| --- |
| sum = 0;  for (int i = 0; i < n; i++)  for (int j = 0; j < n \* n; j++)  sum++; |

d.

|  |
| --- |
| sum = 0;  for (int i = 0; i < n; i++)  for (int j = 0; j < i; j++)  sum++; |

e.

|  |
| --- |
| sum 0;  for (int i = 0; i < n; i++)  for (int j = 0; j < i \* i; j++)  for (int k = 0; k < j; k++)  sum++; |

f.

|  |
| --- |
| sum = 0;  for (int i = 1; i < n; i++)  for (int j = 1; j < i \* i; j++)  if (j % i == 0)  for (k = 0; k < j; k++)  sum++; |